

# Arcotronics Fuel Cells



ROEN EST

*"Arcotronics Fuel cell State of the art of PEFC"*



## Roma Steering Committee IPHE

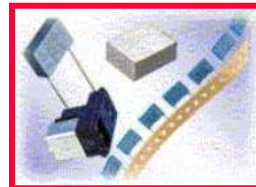
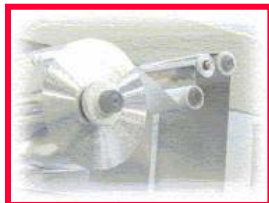
15-11-07

Angelo D' Anzi



## Group Profile

- **Kemet Group**  
founded in 1964.
- **Headquarters in Sasso Marconi (BO) Italy.**
- **Production world leader in:**  
metallized plastic film capacitors a  
machinery for the production of  
capacitors, batteries.
- **Group turnover \$ 200 millions.**
- **1800 employees world wide.**



# ARCOTRONICS FUEL CELL

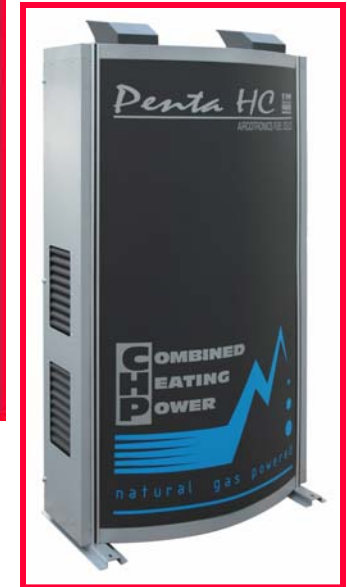


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ARCOTRONICS NISSEI GROUP  
ARCOTRONICS FUEL CELLS srl

## Company Profile

- Arcotronics fuel cells s.r.l.  
founded in 2000 with the name of ROEN EST srl.
- In 2003, was incorporaed to ARCOTRONICS GROUP  
Registered Capital € 500.000,00
- Located in Sasso Marconi, BO
- N° employees 20





## *Our technology*

# ARCOTRONICS FUEL CELLS



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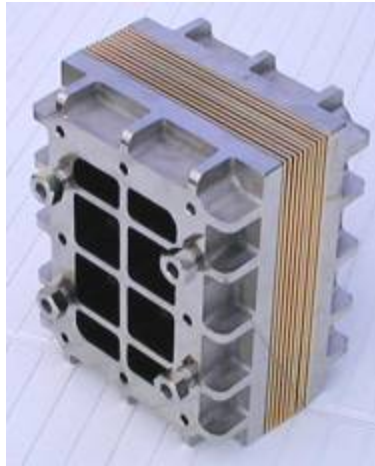
ARCOTRONICS NISSEI GROUP

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## The story



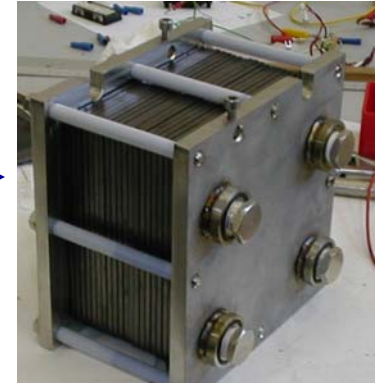
1999-2000



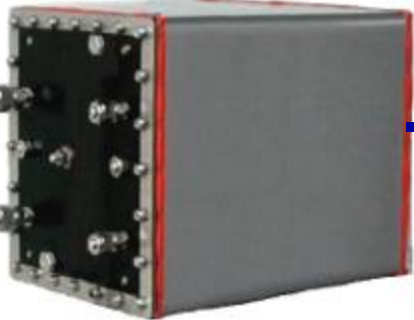
2000



2000-2001



2001



2001-2002



2002



2004



2006

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# ARCOTRONICS FUEL CELLS



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## Production model

POTENZA STACK 500W- 250kW  
MEA manufacturing in house  
Graphite mould plates  
Metallic plates

**Core Technology for MEA and Plates:**  
**MEGA PATENT**  
(membrane electrode gasket assembly)  
**HEFC PATENT**  
(Hybrid electrolyte fuel cells)  
**SCS under PATENT**  
(Security coolant system)

FUEL CELL STACK

STATIONARI SYSTEM

SPECIAL

AUTOMOTIVE

REGEN BACKUP SYSTEM  
WIND SOLAR UPS

STAND ALONE SYSTEM  
APU - PROFESSIONAL

5 KW SMAL CHP  
DOMESTIC COGEN.

1-5 KW APU  
SHIP AND RV

1-250 KW OEM STACS

MEA AND PLATES

MILITAY  
SUBMARINE

AEROSPACES  
STRATOSFERIC BALOON

80 KW FUEL CELL ENGINES  
BUS TRUK CARS SHIP

20 KW FUEL CELL ENGINES  
BUS TRUK CARS SHIP

5 KW FUEL CELL ENGINES  
SMAL VEHICLE

1,7 FUEL CELL ENGINES  
SCOOTERS



## Main Activity

### R&D

- FC components
- Balance of Plant (BoP)
- Industrialization
- Stacks
- System optimisation
- Fuel Processors
  - NG
  - LPG

### Available products

- Penta ( H2 1ph 3 ph SA)
  - 5 kW oem power system
- Electrum H2 1 kW system
- Custom stacks
- 1,7-20 kW fuel cell engine

### Collaborative projects

- NEO Fuel Cells vehicle project
- Aerospace regenerative systems
- 30 kW CHP system

### Financed projects

- Micro CHP (5 kW CHP)
- Celco Yacht (15 kW APU)
- Hyper
- Marghera Idrogeno in azienda
- Arezzo Goldsmiths district

# ARCOTRONICS FUEL CELL PATENT



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## MEGA – Membrane Electrode Gasket Assembly

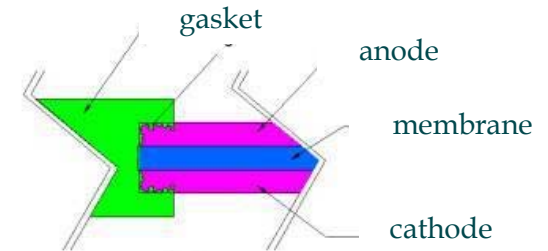
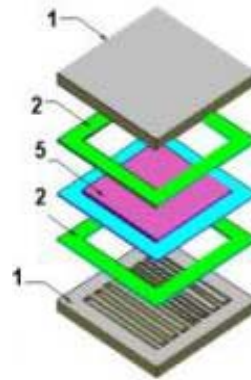
### MEGA Advantages

- COST REDUCTION
- MANUFACTURING
- QUALITY CONTROL
- SHELF-STORAGE
- OPERATION
- MAINTENANCE

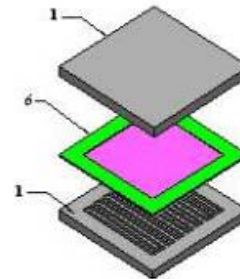
### MEGA production

- Injection Moulding System
- Silicone based mixture.
- Low temperature injection
- Short curing time

### Traditional



### MEGA





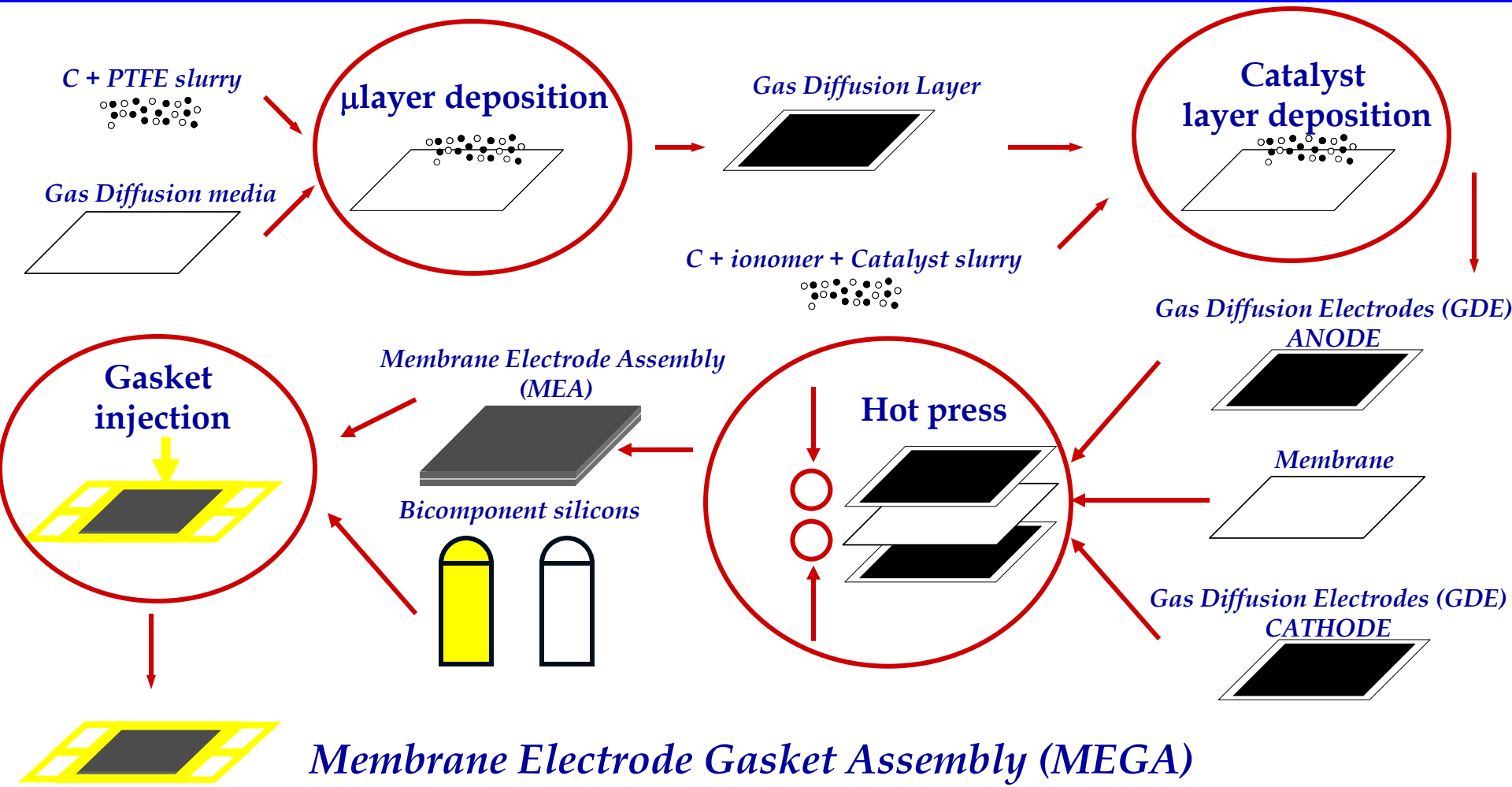
# ARCOTRONICS FUEL CELL



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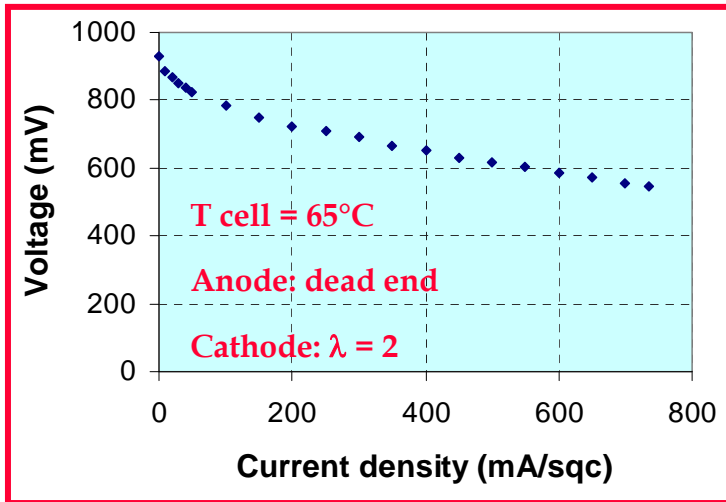
## MEGA system Production



## HEFC – Hybrid Electrolyte Fuel Cell

### Why HEFC

- Humidification management
- Load following operating
- MEA degradation

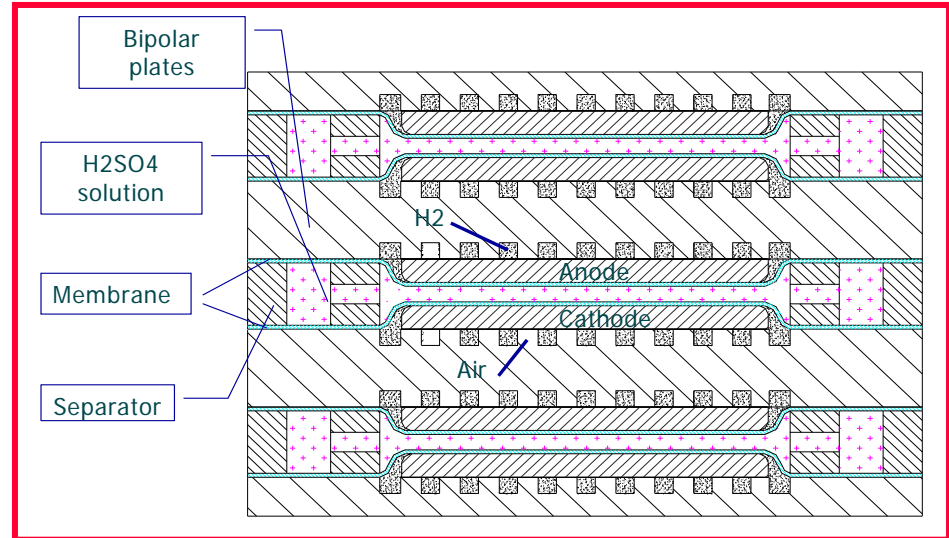


### HEFC Advantages

- Long lifetime is expected
- No external humidification
- Direct cooling of the MEAs
- Uniform operating condition
- Friendly operating
- Immediate start-up
- Full power operating

### Applications

- Stationary
- Transportation
  - Train
  - Bus
- Automotive full power



# ARCOTRONICS FUEL CELL SCS

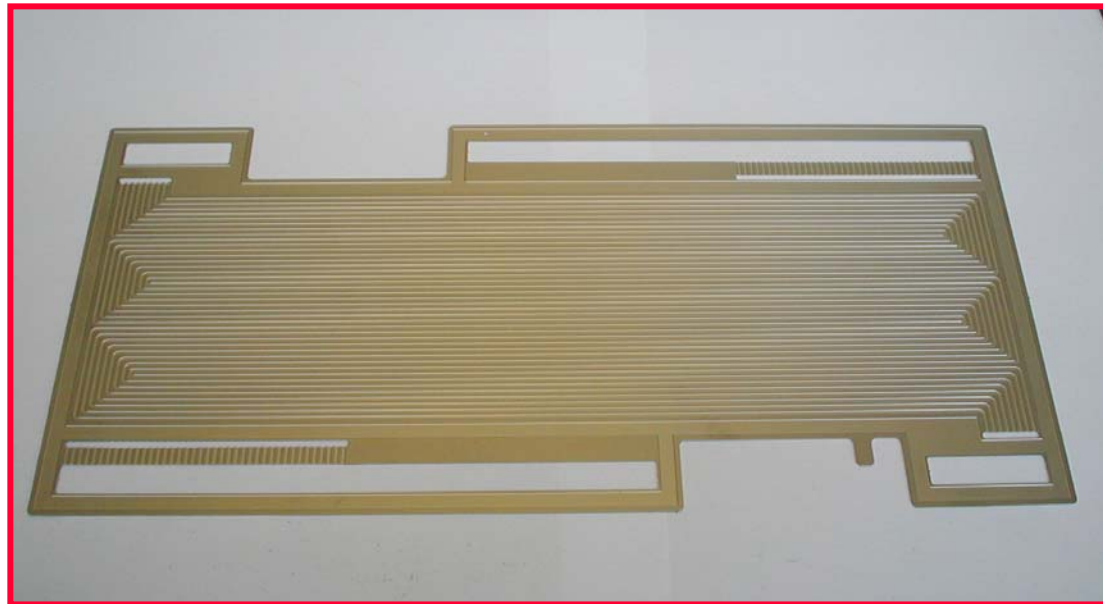


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**Security coolant system**

**UNDER PATENT**



Possibility to use glicole in the cooling circuit  
without any risk contamination.

# ARCOTRONICS FUEL CELL

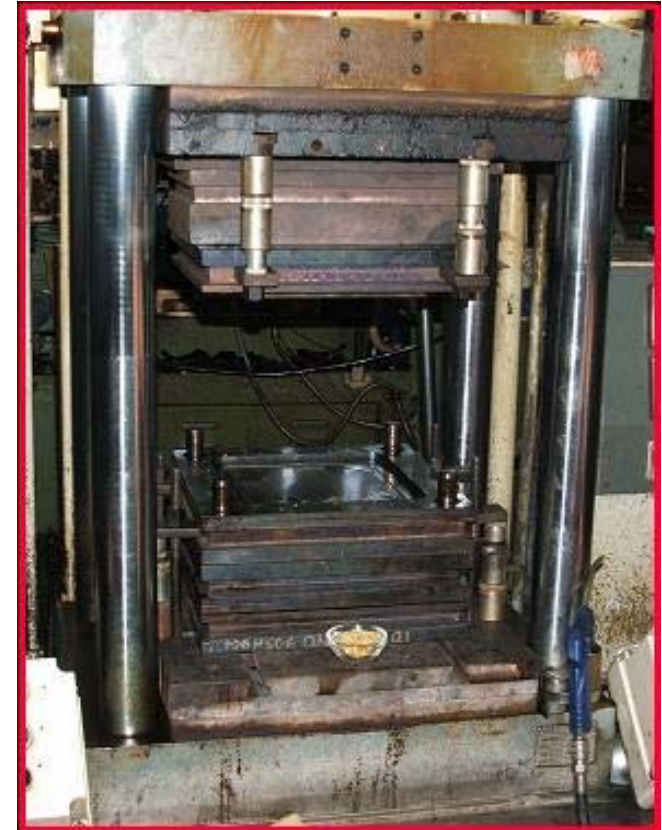


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## Composite graphite plates

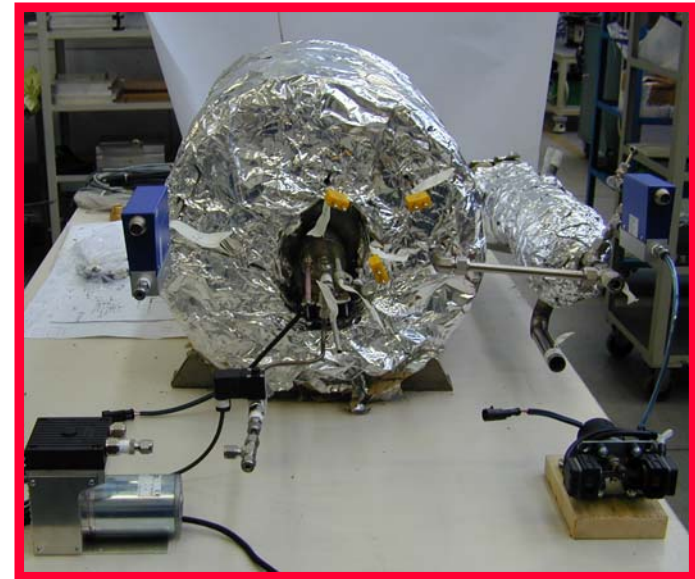
- Moulding time: *< 3 min per plate*
- Price: *< 5 €/plate also for low volume*



## Fuel Processors

# Primary fuels

- NG and LPG





## LPG Fuel Processors

### MAIN CHARACTERISTICS OF THE SYSTEM

<i>Primary fuel</i>	LPG, NG
<i>Gas supply pressure</i>	2-5 bar
<i>LPG consumption</i>	300 g/h
<i>H2 production</i>	1,05 Ncm/h
<i>Operation temperature</i>	0°C to + 50°C
<i>Dimension (L x W x H)</i>	320 x 320 x 440 mm
<i>Weight</i>	< 30 kg
<i>Test on field</i>	2006





## NG Fuel Processors

### MAIN CHARACTERISTICS OF THE SYSTEM

<i>Primary fuel</i>	NG
<i>Gas supply pressure</i>	0,5-1 bar
<i>NG consumption</i>	1,25 Ncm/h
<i>H2 production</i>	5 Ncm/h
<i>Operation temperature</i>	0°C to + 50°C
<i>Dimension (L x W x H)</i>	450 x 450 x 850 mm
<i>Weight</i>	< 100 kg
<i>Test on field</i>	2006



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***PRODUCTION***



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## Stationary Available Products



5 kW

CHP grid  
connected

Natural Gas

Prototype  
stage

### Electrum

1 kW

Portable UPS

H<sub>2</sub>/Air



### New Penta H2

5 kW

CHP grid  
connected

H<sub>2</sub> fuel



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## Mobility available products



25 kW FC

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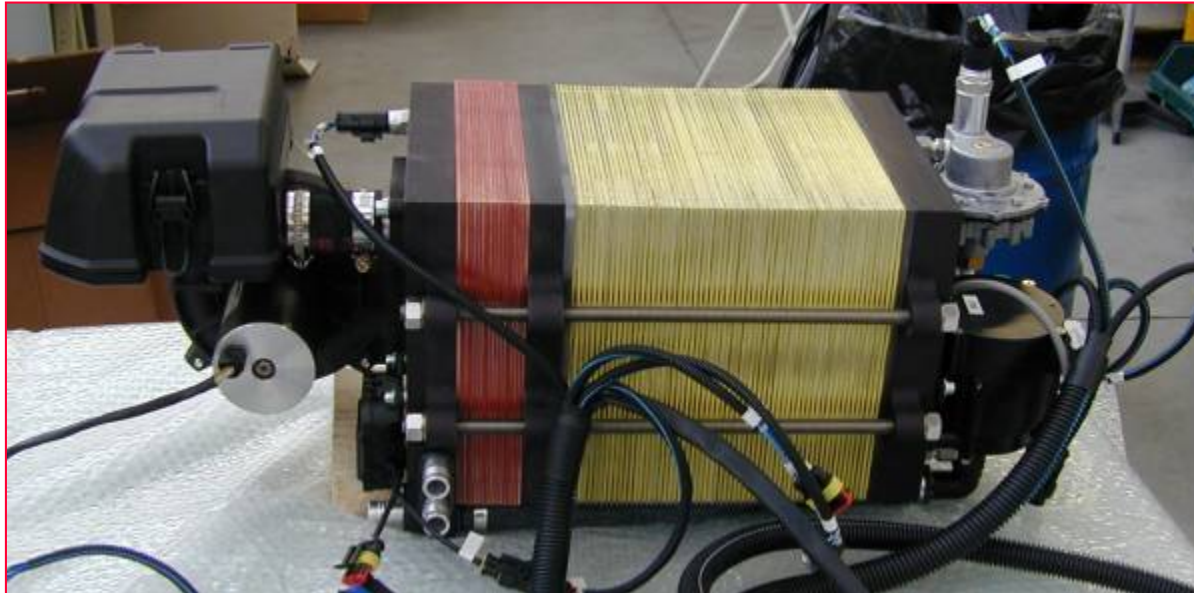
# ARCOTRONICS FUEL CELLS



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## Mobility available products



### 5 kW FCE

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## Mobility available products



0,3-1,5 kW FCE

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## *PROJECTS IN PROGRESS*

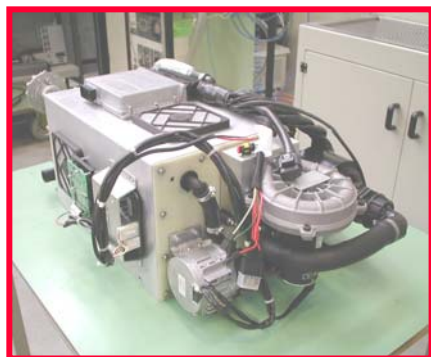
# ARCOTRONICS FUEL CELLS



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## 12 kW FC – hybrid vehicle



**NEO**  
No Emission Outfit



**MICRO-VETT**  
veicoli elettrici

### Vehicle Performances (Electrical vs. Fuel Cell)

	Daily 65 Electrical	Daily 65 H2
Autonomy	70 to 120 km	150 to 250 km
Loading capacity	Up to 3910 kg	Up to 3600 kg
Battery capacity	60 kWh	60 kWh

### STACK FEATURES

<i>Nominal Power</i>	12 kW
<i>H<sub>2</sub> Consumption</i>	0.83 Nm <sup>3</sup> /kWh
<i>Dimensions (mm)</i>	250x250x800

*Test on field*

**2007**

# ARCOTRONICS FUEL CELLS



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## 12 kW FC – hybrid vehicle



*On the road test*

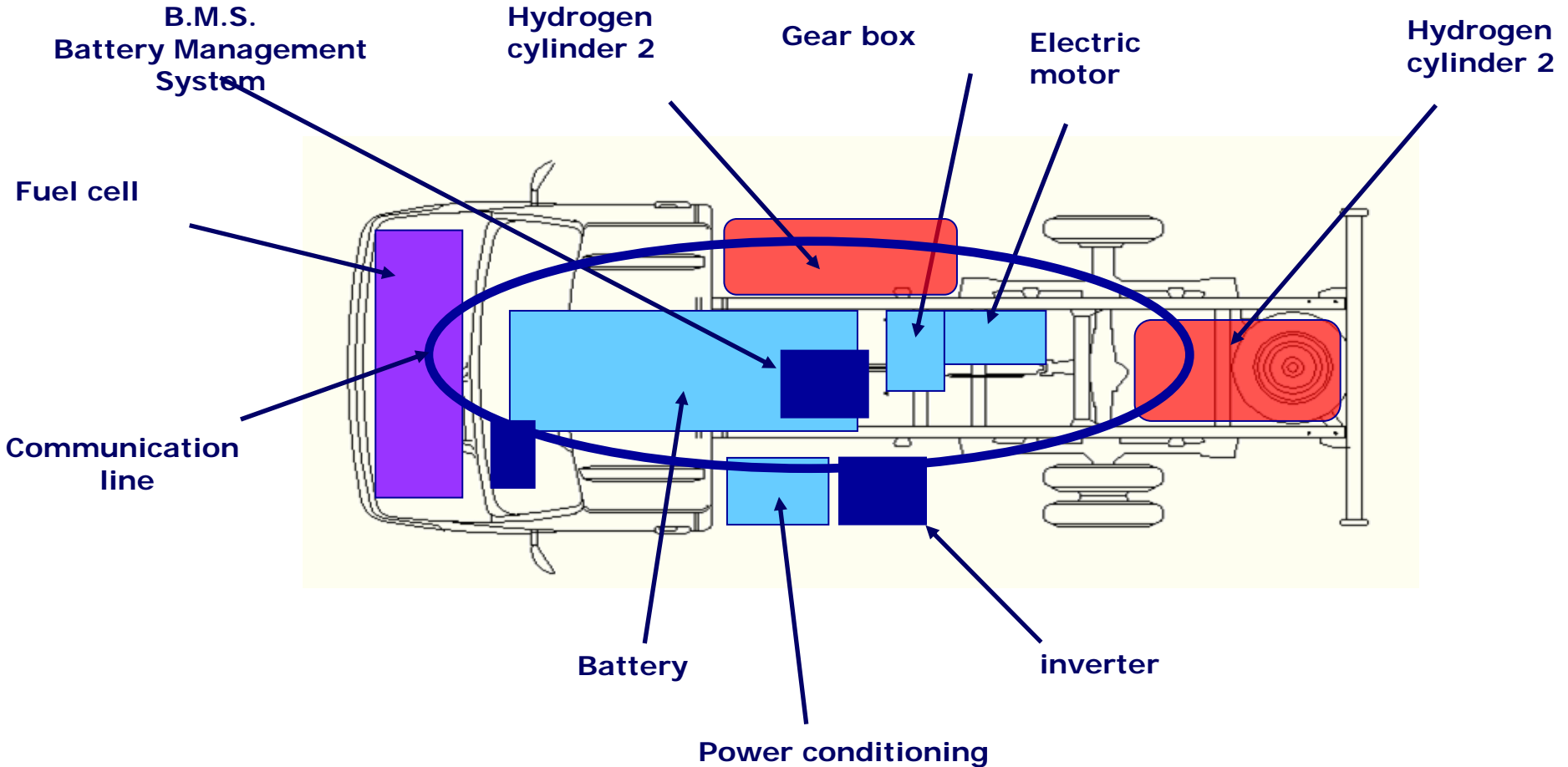
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## 12 kW FC – hybrid vehicle



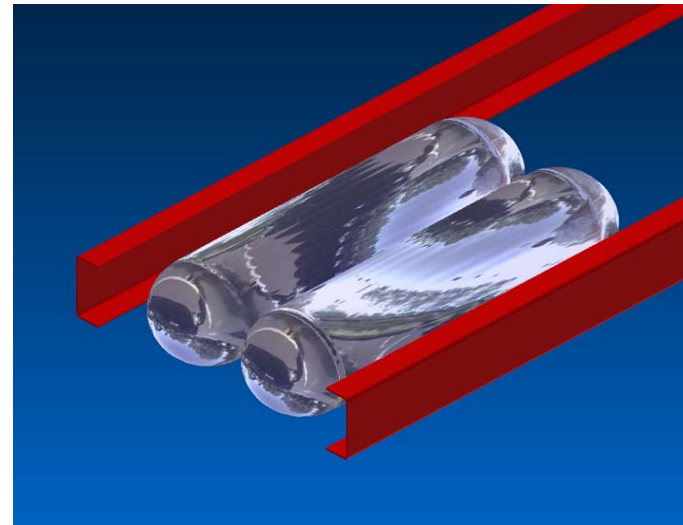
# ARCOTRONICS FUEL CELLS



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## 12 kW FC – hybrid vehicle



**Fuel Storage: 2 x M039H350**

**Capacity: 2.5 kg H<sub>2</sub>**

**Weight: 54 kg**



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## ZEV 1



<u>Features</u>	
Configuration	Full power
Autonomy	80 km
Loading capacity	Up to 700 kg
FC Max Power	20 kW

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# ARCOTRONICS FUEL CELLS



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## ZEV 1



Hydrogen  
cylinder

Fuel Cell

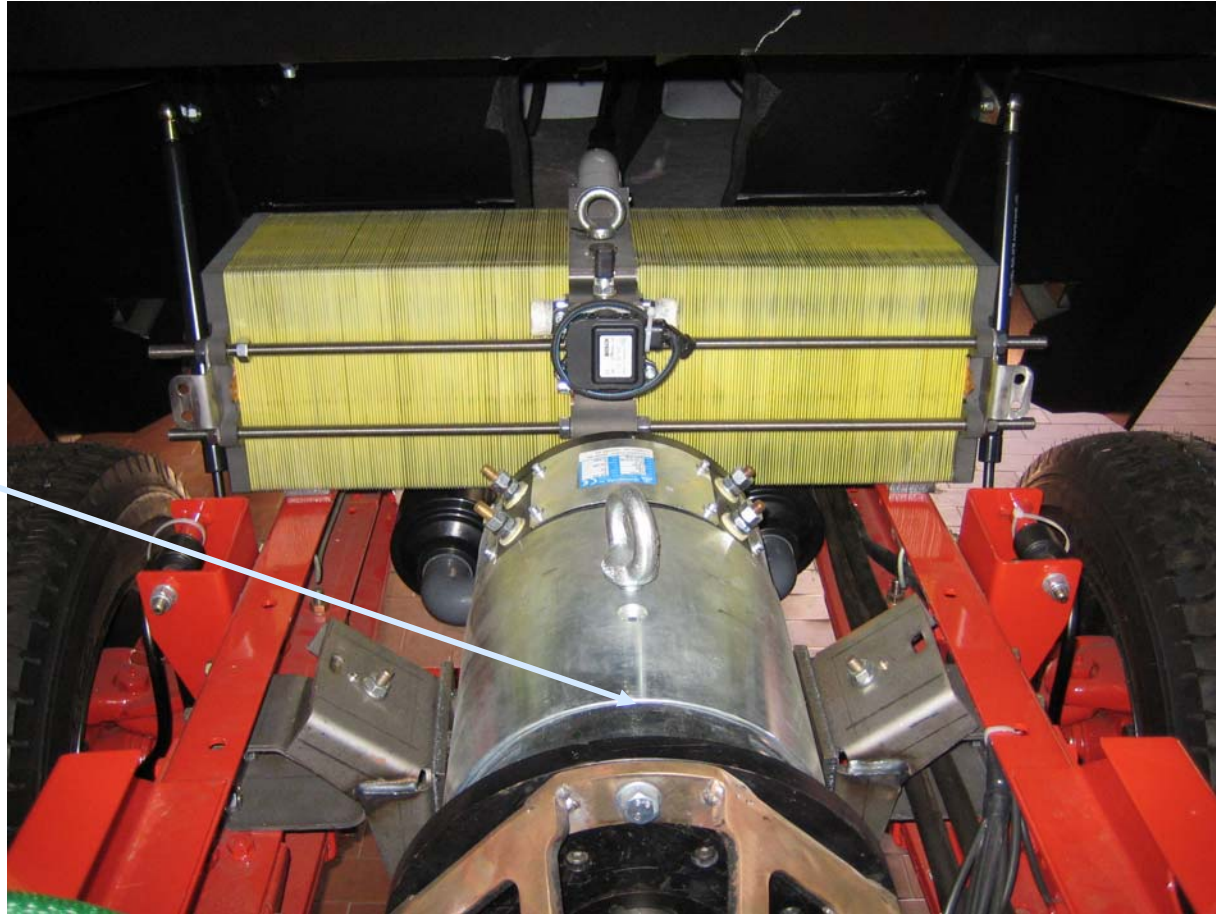
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## ZEV 1



Electric  
Motor

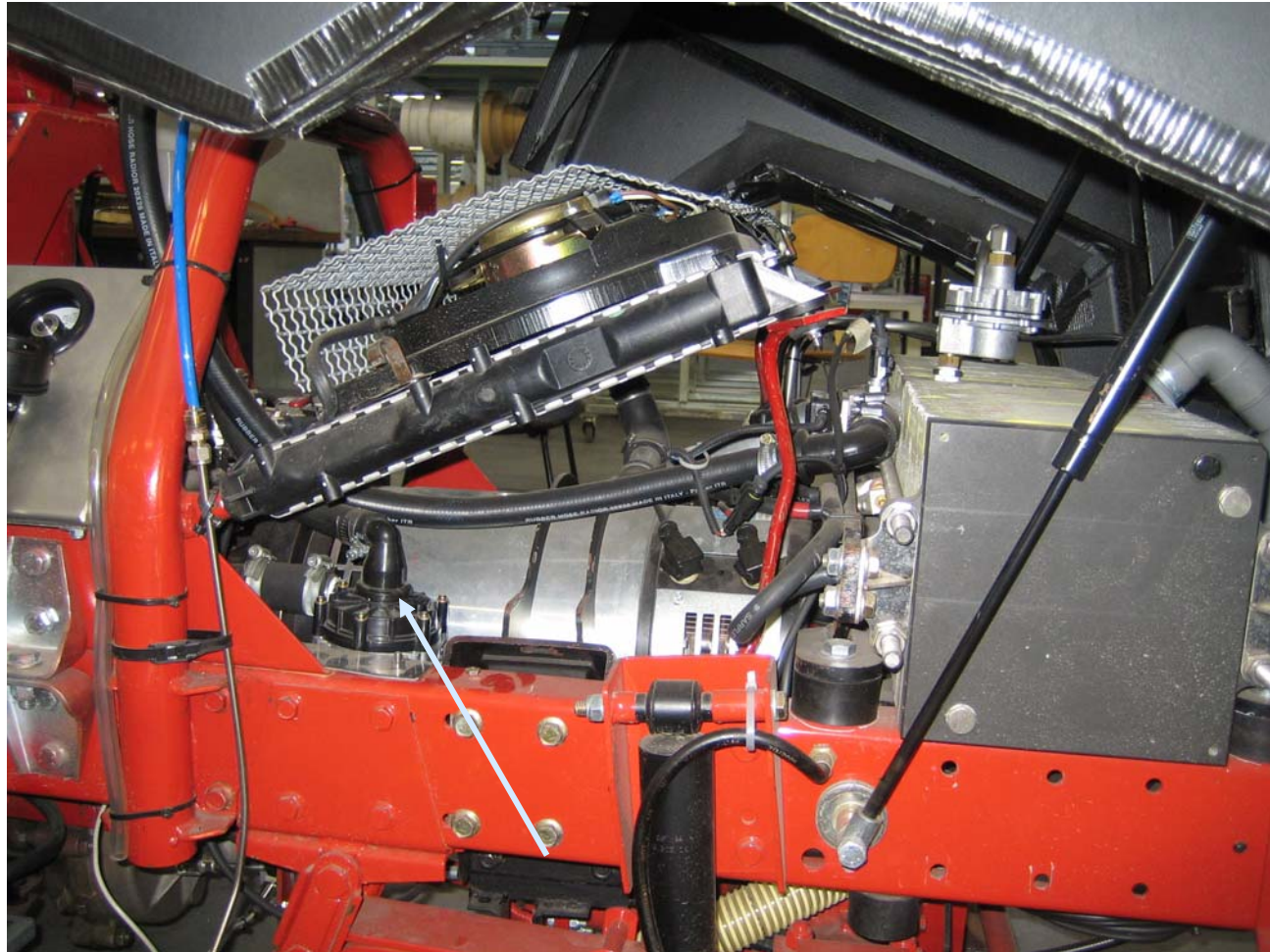
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## ZEV 1



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## ZEV 2



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## ZEV 2



### Scooter Performances

<b>Max Speed</b>	45 km/h
<b>Autonomy</b>	Da 50 a 80 km
<b>Loading capacity</b>	Fino a 108 kg
<b>Hydrogen capacity</b>	160 g



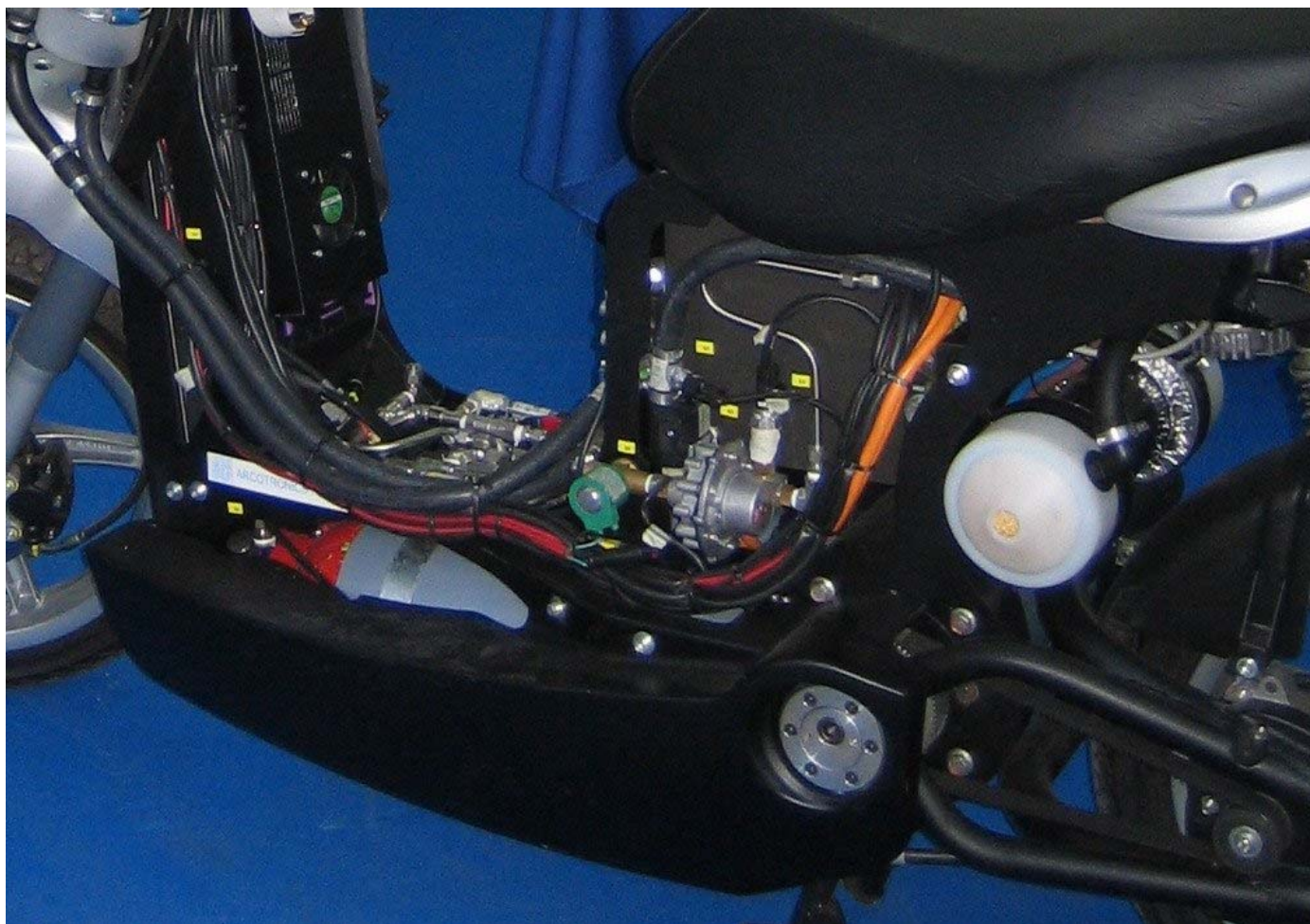
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## ZEV 2



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## H2 at Arezzo Goldsmiths district



On site H2 production



H2 pipeline



CHP units



Cooperativa  
La Fabbrica del Sole

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# ARCOTRONICS FUEL CELLS



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15 kWe – Naval APU



Hydrogen System Laboratory  
HYSY.LAB



ENVIRONMENT  
PARK



## MAIN CHARACTERISTICS OF THE SYSTEM

<i>Primary fuel</i>	Petrol
<i>Nominal electric power</i>	5 kw
<i>Net efficiency</i>	> 30%
<i>Heat recovery possibility</i>	4 kW
<i>Test on field</i>	2007

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## Domestic 4 kWe



Wärme ist unsere Welt.

**ELCO  
KLOCKNER**

Heiztechnik



ENVIRONMENT  
PARK



**MTS**  
GROUP

|Hydrogen|System|LABoratory|  
HYSY.LAB

## MAIN CHARACTERISTICS OF THE SYSTEM

<i>Primary fuel</i>	Natural gas
<i>Electric power</i>	1-4 kw
<i>Thermal power</i>	4-24 kW
<i>Net electric efficiency</i>	> 30 %
<i>Overall efficiency</i>	> 80 %
<i>Test on field</i>	2006

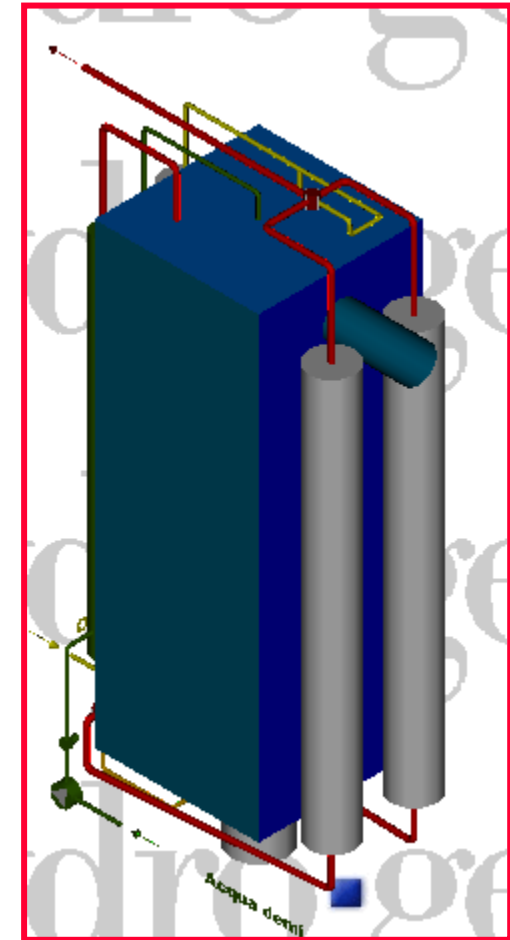
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## 30 kW industrial CHP



### MAIN CHARACTERISTICS OF THE SYSTEM

<i>Primary fuel</i>	Natural gas
<i>Electric power</i>	30 kW
<i>Thermal power @ 65°C</i>	45 kW
<i>Net electric efficiency</i>	> 33 %
<i>Overall efficiency</i>	> 80 %
<i>Test on field</i>	2006

